

2009 Red King Crab Juvenile Rearing Experiments

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This study will test effects of diet, stocking densities, and size grading, on survival, growth, and coloration of juvenile king crab using indoor rearing tanks as nurseries for mass culture.

EXPERIMENT 1: Effects of diet and stocking density on survival, growth, and coloration of juvenile red king crab.

HI₀: There will be no difference in survival, growth, or coloration when fed four different diets.

HI_a: Survival, growth, and coloration differ among tanks when fed different diets.

III₀: There will be no difference in survival or growth of juvenile king crab when reared at a density of 2000 or 4000 crabs m⁻².

III_a: Survival differs among tanks at different densities.

Recently settled (C1) crabs from the larval density, diet, and production experiments will be collected, mixed randomly and placed in containers (silos) at two different densities (2000, 4000 crabs m⁻²). Diets will consist of a mixed diet (Cyclopeeze™, Otohime, frozen enriched Artemia, Zeigler shrimp nursery feed, krill powder), a mixed diet with calcium enrichment, a mixed diet with astaxanthin, and a mixed diet with calcium enrichment and astaxanthin. Calcium enrichment will consist of krill powder, ground cuttlebone, and egg white. Astaxanthin is naturally found in *Haematococcus pluvialis* microalgae and is commonly used in aquaculture as a color additive. Astaxanthin will be mixed with the other feeds and will be added to enrichment media of Artemia in an attempt to produce darker red king crab juveniles. Each treatment will consist of 5 replicates. All silos will contain substrate consisting of equal volumes of Fukui artificial seaweed and commercial gillnet. Crabs can move freely among different substrates within a silo. Optimal temperatures (8-12°C) for juvenile king crab will be maintained to attempt to decrease intermolt duration.

The duration of the experiment will be 8 weeks to determine overall survival, growth, and coloration of early juveniles for practical enhancement purposes. Survival and growth of juveniles will be assessed by counting, weighing and measuring (CW) the crabs at the end of the experiment. Difference in survival of juveniles between treatments will be determined by ANOVA after 8 weeks. Coloration will be determined with digital photography and Adobe Photoshop to identify hue (shade of color), saturation (amount of hue), and brightness (light vs. dark) (Davis et al. 2005). T tests will determine significant differences in color based on hue, saturation, and brightness parameters.

Each silo is a cylindrical container with a mesh screen bottom with surface area of approximately 0.25 m². When immersed in the SS tanks, each silo can be operated at a depth of up to about 20 cm, yielding a seawater volume of approximately 65 L silo⁻¹. Each silo will have a small size mesh (100 µm) on bottom to allow water exchange but retain food.

Total C1s needed: 30,000.

		Stocking Density (crabs/m-2)
Treatment	Diet	
1	mixed	2000
2	mixed	4000
3	mixed w/ calcium	2000
4	mixed w/ calcium	4000
5	mixed w/ astaxanthin	2000
6	mixed w/ astaxanthin	4000
7	mixed w/ calcium, astaxanthin	2000
8	mixed w/ calcium, astaxanthin	4000

EXPERIMENT 2: Effects of diet and size grading on survival, growth, and coloration of red king crab.

HI₀: There will be no difference in survival, growth, or coloration when fed a diet enriched with calcium and astaxanthin.

HI_a: Survival, growth, and coloration differ among tanks when enriched with calcium and astaxanthin.

III₀: There will be no difference in survival or growth of juvenile king crab when reared at uniform size vs. a varying size range.

III_a: Survival and growth differs when rearing at a uniform size compared to a mixture of size ranges.

Crabs from the previous juvenile rearing experiment (likely C2s and C3s) will be collected, separated into two size classes (large vs. small vs. mixture of large and small) and placed in containers (silos). Diets will consist of a mixed diet (Cyclopeeze, Otohime B1, frozen enriched Artemia, Zeigler shrimp nursery feed, krill powder) and a mixed diet enriched with calcium and astaxanthin. Calcium enrichment and astaxanthin will be administered as described above. Stocking density for all silos will be 1000 crabs m⁻². Each treatment will consist of 6 replicates. All silos will contain equal volumes of Fukui artificial seaweed and commercial gillnet. Crabs can move freely among different substrates within a silo as described above. Optimal temperatures (8-12°C) for juvenile king crab will be maintained as described above.

The duration of the experiment will be 8 weeks to determine overall survival, growth, and coloration of early juveniles for practical enhancement purposes. Survival and growth of juveniles will be assessed by counting, weighing and measuring (CW) the crabs at the end of the experiment. Difference in survival of juveniles between treatments will be determined by ANOVA after 8 weeks. Coloration will be determined as described above.

Total crabs needed: 9,000.

	Size	
Treatment	Class	Diet
1	small	Mixed
2	small	Mixed w/ calcium, astaxanthin
3	large	Mixed
4	large	Mixed w/ calcium, astaxanthin
5	mixed	Mixed
6	mixed	Mixed w/ calcium, astaxanthin

Reference

Davis, J.L.D, M.G. Eckert-Mills, A.C. Young-Williams, A. Hines, and Y. Zohar. 2005. Morphological conditioning of a hatchery-raised invertebrate, *Callinectes sapidus*, to improve field survivorship after release. *Aquaculture* 243:147-158.